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BORDEN'S REVIEW *of* NUTRITION RESEARCH

NUTRITION IN INDUSTRY

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NUTRITION IN INDUSTRY

"Great Britain has learned in the bitter school of wartime experience the fundamental importance of maintaining the health and morale of civilians. Now that we are at war we should not fail to profit by lessons learned at such cost abroad. Among civilians, workers in defense industries are of strategic importance, as on their working efficiency depends to a considerable degree the hope of ultimate victory. For the output of arms, munitions of every kind, and all the material needed in modern warfare, are dependent in the final analysis on the health and morale of these defense workers. Nutrition is not the only factor in health and morale, but it is one of the most important factors. The improved health and morale which result when inadequate diets are brought up to adequate levels may be translated into greater working efficiency, fewer absences from work, and a decrease in the number of accidents. These and other possible benefits should speed production, the crying need of our country and of our allies in the fight for freedom."—Committee on Nutrition In Industry, National Research Council Circular 110, April, 1942.

The pressing need for war production has placed renewed emphasis on the health and morale of the civilian population, especially those engaged in vital war industries. An adequate diet is one of the most important factors in maintaining good health and morale. Furthermore, scientific studies have disclosed that improving the nutrition of workers pays direct dividends in increased productivity and efficiency. Progressive industry has been quick to realize these facts and has steadily maintained efforts to contribute to better nutrition by improving eating conditions and food habits among workers.

Because of the increased burdens and stresses imposed by heightened wartime activity, the problem of maintaining an adequate nutritional level, particularly among industrial workers, has become exceedingly complex. This Review will attempt to set forth the reasons for existing nutritional inadequacy among workers, while a subsequent Review will reveal what steps are being taken by government and industry to cope with this vital problem.

The concentration of industrial workers in large defense areas often involves lengthy hours of travel to work, inadequate housing and feeding facilities, irregular working hours and similar problems. These problems exert a significant influence upon health and food habits. Meals, especially breakfasts, are frequently skipped because of lack of time, or else are replaced by hasty, inadequate snacks such as doughnuts and coffee at lunch counters; gasoline rationing has curtailed the practice of driving to nearby towns for meals; long hours of overtime and irregular work shifts may disrupt sleeping and eating habits; increased working duties impose increased food requirements. The added burdens of housewives who may also be engaged in war work are often reflected in the inferior quality of the meals they prepare hastily after work, or in the inadequate lunch boxes prepared

under equally adverse conditions of haste and fatigue. Many large plants formerly equipped with adequate eating facilities are now finding it difficult to cope with the problem of a tremendously increased number of employees. These are only some of the factors which heighten the degree of malnutrition already existing in normal times.

Preliminary Surveys:

The growing awareness of the importance of malnutrition as an industrial health and production problem led to the formation in 1941 by the National Research Council of the Committee on Nutrition in Industry. This committee, composed of physicians and nutrition authorities, initiated a general survey of the problem and set up local sub-committees throughout the country to investigate the nutrition of selected groups of workers and of their families and the eating facilities both for regular meals and snacks afforded by various industrial plants. In 1942, a brief report of the Committee's findings was published, together with a series of recommendations for improving existing nutrition conditions.

In New England the sub-committee recommended that workers' lunches provided by plant cafeterias include: (1) a serving of milk, cheese or other dairy product, (2) fruit or vegetables, and (3) one "substantial" or main dish. Lunches selected by workers ranged from poor (meeting one or none of the requirements) through fair (meeting only two of the requirements) to good (meeting all three requirements). In a large manufacturing plant, for example, 57% of the lunches selected by all the employees was rated poor. Of these, lunches of office workers were rated as 39% good, 42 per cent fair and 19 per cent poor. Among the factory workers there were 52 per cent good lunches, 45 per cent fair and 3 per cent poor. Many plants have recognized that provision of a good diet for their employees and of adequate eating facilities are important aids to production. Successful establishment of such conditions has not yet been fully realized. Analysis of a war plant questionnaire survey in New York State, for example, revealed (2) that:

1. More than one-half the plants provided no lunch room facilities for workers.
2. In only one plant out of five was hot food purchasable.
3. Only one-half of the plants had milk available for their employees.
4. In three-quarters of the plants only 30 minutes or less was allowed for lunch.

Southern California Survey: One of the earliest large-scale surveys of the diets of industrial workers was undertaken in 1941 at the Lockheed Aircraft Corporation in Burbank, California. Prior to this study, data obtained from the Stiebling-Phipard (3) survey of 4,000 family

dietaries throughout the country had indicated that the food situation in the Southern California area was one of the best in the country because of its liberal supply of milk and milk products, citrus fruits, fresh vegetables and meat. Nevertheless, analysis of the diets at the Lockheed plant in this area by Wiehl (4) revealed a very unsatisfactory nutrition picture. Such factors as the tremendous and sudden expansion of the plant, a great influx of workers, lack of suitable housing and eating facilities, have been offered as possible explanations for this discrepancy (5). Poor selection of available foods by the workers themselves is an important contributory factor. Detailed study of the diets of more than one thousand workers over a period of three months, revealed the following interesting facts:

1. When amounts of all five food groups listed in the tables below, in an individual diet were considered, it was found that: 2 per cent of the diets included amounts of each of the five types of foods as described in Table I; 11 per cent had smaller amounts for one or more types of foods but none as low as described in Table II; and 87 per cent of the diets had amounts as low as described in Table II for one or more food groups. The latter group of 87 per cent included: 32 per cent of diets low in one food group, 36 per cent low in two food groups, 16 per cent low in three food groups, and 3 per cent low in four food groups.
2. Young men had somewhat better diets than the older men. Men under 25 years of age drank more milk and ate more citrus fruits than those 25 years or older, but had a similar consumption of green and yellow vegetables and eggs.
3. Two hundred and fifty complete two-day diet records, for which estimated amounts of each food were reported, were analyzed to obtain approximate values for their nutritive content in calories, protein, calcium, iron, vitamin A, ascorbic acid, niacin, thiamine, and riboflavin. The percentages of these diets in which the amount of a specific nutrient was less than two-thirds of the recommended daily allowance were: protein, 0.8 per cent; iron, 4.0 per cent; niacin, 7.2 per cent; thiamine, 14.0 per cent; vitamin A, 14.8 per cent; calcium, 24.8 per cent; riboflavin, 43.2 per cent; ascorbic acid, 46.0 per cent.
4. Among the 250 two-day diets, there was 71.6 per cent in which one or more of the mineral and vitamin nutrients was less than two-thirds of the daily allowance. The average number of nutrients below this intake level was 2.15 per cent.

The median caloric intake was 2,675 calories per day, and only 34 per cent of the diets furnished an estimated 3,000 calories or more per day.

I. Percentages of diets which included amounts per week equal to or slightly below that recommended were:

	Per Cent
Green or yellow vegetables, 6 or more	21
Citrus fruits or tomatoes, 7 or more	36
Milk, 10 or more glasses	51
Eggs, 4 or more	59
Lean meat, fish, etc., 5 or more times	95

II. Percentages of diets which included amounts definitely below that recommended were:

	Per Cent
Green or yellow vegetables, 3 or less—43 per cent....	56
Less than 7 vegetables, with 5 or less green or yellow—13 per cent	
Citrus fruits or tomatoes, 4 or less	49
Milk, 5 glasses or less	33
Eggs, 1 or none	23
Lean meat, etc., 2 or less times	1

New York: Goodhart (6) cites similar situations for the East Coast. A survey of a large plant cafeteria near Albany by the New York State Nutrition Committee showed that men consistently selected lunches of meat, potato, bread, pie and milk, while girls usually chose sandwiches, pie and coffee. There were few trays with a vegetable or salad. It was suggested that consumption of these latter foods might be markedly increased by giving more attention to their attractive preparation and serving. Shorter cooking time and better refrigeration are two means for achieving this.

Preliminary surveys by the New York State Health Department revealed that in one plant only 24 per cent of the workers ate a good lunch, despite the availability of a liberal offering of protective foods. In another plant only 12 per cent had good lunches, and in a third plant, where the choice of foods was very limited, none of the workers had good lunches and more than three-quarters had definitely poor lunches. Goodhart found the economic factor to be one very important reason for the selection of inadequate lunches. Inclusion of more of the protective foods in the low-priced daily "specials" is suggested.

Another factor resulting in the widespread consumption of inadequate lunches is the shortness of the lunch period – sometimes only 20 minutes. Because employees do not have time to go to lunch rooms, food carts are often sent into the factory. These lunch carts should be stocked with nutritious foods such as milk, orange juice, a hot dish when possible, fruit, etc., instead of only with foods of low nutritional value as sweets, coffee and soft drinks.

Lunch Boxes: Because of prevailing conditions such as those described, the chief source of the mid-day meal is frequently the lunch box. A great majority of workers do not carry lunch boxes from home, but purchase them at or near the shipyard. Sample lunch boxes made up by four companies were offered for nutritional examination by two well-known shipyards. Turlay (7) reports that none of these met National Research Council standards which recommend that the mid-shift meal in a factory supply one-third of the day's requirements of calories, protein, minerals and vitamins. The best lunch approximated the requirements for calories, protein, iron, and sometimes

calcium. It was low in vitamin A, thiamine and riboflavin. The other box lunches were even lower in these essentials, as well as in calcium and protein. In view of the shortage of fats and the increased use of carbohydrates, it was suggested that the thiamine content of the diet needed to be high if maximum efficiency and health are to be maintained (8, 9, 10). Box lunches can be improved by including foods like eggs, low point-value rationed meats and cheeses, and peanut butter.

Reasons for Nutritional Inadequacy:

The preliminary diet surveys thus far conducted by national and local nutrition committees have all revealed a serious degree of nutritional inadequacy among workers in industry. Aside from its significant public health aspect, this situation is of utmost importance to war-time industry. It has been repeatedly pointed out that proper nutrition of workers is a factor which not only results in, but is essential for, greater working efficiency, fewer absences from work and a significant decrease in the number of accidents. There are many reasons for the unsatisfactory nutritional status now prevalent among a great proportion of our industrial workers. A number of these have already been brought out as a result of the surveys described. The Committee on Nutrition in Industry has classified the causes of nutritional inadequacy under four headings: poor food habits, economic factors, poor commissary facilities and metabolic stress (1).

Poor Food Habits: Faulty food habits, as has been pointed out, include omission of regular meals or the substitution of inadequate foods, such as pastry and coffee; also, poor selection of foods for meals even when a good selection and adequate eating facilities are offered. Protective foods such as milk, fruit, vegetables, salads, and the like are frequently omitted in favor of such foods as "hot dogs," doughnuts and sweetened carbonated beverages. These practices, resulting from faulty food habits, food prejudices, racial and social customs, indifference and ignorance can be combated only by a vigorous educational campaign. The National Nutrition Program, begun some years ago, has made an excellent beginning in educating the public in the principles of good nutrition with the widespread publicity through the press, radio and such slogans as "Eat a Lunch that Packs a Punch," and "Every Day Eat This Way," the latter referring to the "basic seven" food groups: (1) milk, cheese, ice cream and related dairy products, (2) green and yellow vegetables, (3) oranges, tomatoes, grapefruit, etc., (4) potatoes and other fruits and vegetables, (5) meat, poultry, fish or eggs, (6) enriched or whole grain bread, flour and cereals and (7) butter or fortified margarine.

Economic Factors: Economic factors involve not only the ability or willingness of the worker to spend an adequate amount of money for food, but the relative prices charged for foods. As found by Goodhart (6), attractively priced luncheon "specials" are given preference by the worker who does not wish to pay extra for other foods. The "specials," therefore, should be planned to include such nutritious foods as milk, fruit juices and salads.

Poor Commissary: This term covers the provision of foodstuffs by producers, restaurants, manufacturers, and housewives from which it is difficult, and sometimes impossible, to select foods which will satisfy nutritional needs. In the case of industrial nutrition it includes also inadequate facilities for eating, shortness of the lunch period, as well as lack of a suitable selection of foods. Furthermore, no matter how excellent the variety of foods available, there is much evidence that faulty practices sometimes associated with large-scale food preparation and service result in serious losses in nutritive values.

(Food Losses in Cookery): Goodhart (6) remarks: "Any campaign to convince the workers of the desirability of selecting proper meals at plant food dispensaries must be predicated on an assurance that the recommended foods possess the nutritive qualities attributed to them. Unfortunately altogether too frequently it is impossible to give such assurance." In illustration, he cites the results of assays of representative cafeteria meals served in a New York war plant. Table III summarizes the findings on the daily "special" meal offered employees. The vitamin content of the meal, as estimated from data on the nutritive value of raw foods, was found to supply appreciably more than one-third of the recommended allowances for a moderately active man, except for vitamins A and C. Assay of the meal after preparation and service, however, revealed a 92 per cent loss of thiamine (compared with the fresh, raw food) and an 82 per cent loss of vitamin C. Eighty-seven per cent of the available thiamine in this meal was provided by the meat, beans and potatoes, a condition associated with a 92 per cent loss of the vitamin in cooking. In the nutritionally adequate meal (Table IV) selected by Dr. Goodhart from the available foods at almost twice the cost of the "special," the meat, potatoes and carrots provided 40 per cent of the thiamine, of which the total loss in cooking amounted to 52 per cent. The only vitamin C left in the meal was that provided by the tomato juice.

On the basis of these findings, a modified "special" meal was suggested to the management. This meal was essentially the same as the original "special" except for the use of a brewers' yeast extract in flavoring the meat, the substitution of a boiled potato for mashed, the replacement of plain white bread with enriched bread and of coffee

TABLE III.—*Thirty Cent Daily Special April 29, 1942*

Food Items	Weight of Portions, Ounces	Estimated Vitamin Content Based on Literature: Vitamin A, International Units	Thiamine Hydrochloride, International Units	Ascorbic Acid, International Units	Riboflavin, Sherman-Bourquin Units	Niacin
Braised breast of lamb (edible portion)	7½	0	213	0	234	
Mashed potatoes	3¼	52	37	200	18	
String beans	2¼	703	20	278	38	No data available
White bread (2 slices)	2⅜	0	21	0	18	
Butter (1 pat)	¼	300	14	0	0	
Cream (light)	1	284	6	0	37	
Coffee (1 cup)	...	...	..	..	..	
Estimated vitamin content of entire meal, based on literature		1,339	311 (0.9 mg.)	478 (24 mg.)	345 (1 mg.)	No data
Percentage of daily requirements		26.8	50.0	32.0	37.0	
Results of analyses of vitamin content of entire meal		.....	0.073 mg.	4.3 mg.	1.23 mg.	9.0 mg.
Percentage of daily requirements		No data	4.1	5.7	45.6	50.0
Percentage lost in preparation		No data	91.9	82.0	0	No data

Protein (N × 6.25) 26.9 Gm. (13 per cent of total solids of meal). Total calories 1,218.

TABLE IV.—*Fifty-Seven Cent Diet Selected with Attention Paid to Nutritive Value of Foods April 29, 1942*

Food Items	Weight of Portions	Estimated Vitamin Content Based on Literature: Vitamin A, International Units	Thiamine Hydrochloride, International Units	Ascorbic Acid, International Units	Riboflavin, Sherman-Bourquin Units	Niacin
Tomato juice	4½ oz.	1,000	32	600	20	
Roast beef (well done)	3 oz.	18	60	31	70	
French fried potatoes	3½ oz.	56	40	220	20	
Carrots	2 oz.	3,000	13	43	17	No data available
Whole wheat bread (2 slices)	2¾ oz.	0	94	0	32	
Butter (1 pat)	¼ oz.	300	14	0	0	
Milk	½ pt.	414	29	34	175	
Cocoanut custard pudding with whipped cream	5 oz.	No data	No data	No data	No data	
Estimated total vitamin content (minus pudding)		4,788	282 (0.84 mg.)	928 (46 mg.)	334 (1.0 mg.)	No data
Percentage of daily requirements		95.8	46.7	61.3	37.0	
Results of analyses of vitamin content of entire meal		.....	0.4 mg.	*25-30 mg.	2.16 mg.	8.6 mg.
Percentage of daily requirements		.....	22.2	33.3-40.0	80.0	47.9
Percentage lost in preparation		No data	52.4	34.8-45.7	0	No data

Protein (N × 6.25) 15.9 Gm. (7.4 per cent of total solids). Total calories 1,094.
* Tomato juice assayed separately 495 international units (24.75 mg.).

with milk, and the addition of a fresh raw salad. The cost was increased ten cents. Analyses showed a much better retention of vitamins, indicating that with proper selection and handling, good food can be delivered without excessive loss in nutritive value. Increasing adoption of similar practices in industrial cafeterias throughout the country is an important step toward improving workers' diets.

As Harris (11) has pointed out, whether food is obtained from an expensive restaurant or cheap cafeteria may not reflect its nutritive value since methods of preparation and serving may be poor in both places. In some instances where food remained on steam tables after cooking vitamin losses of more than 95 per cent were found.

Heller, McCay and Lyon (12), in an analysis of meals served at a navy yard, found the following percentages of vitamin losses due to methods of cooking and serving: thiamine 16 to 24, niacin 2 to 16, riboflavin 22 to 45, ascorbic acid 27 to 90. Recommended changes in cooking time and time of holding between cooking and serving resulted in improved nutritive value as well as better texture, flavor and appearance of the foods. Addition of brewers' yeast to cooked meat dishes also markedly enhanced the food value of the diet (13).

A number of laboratory studies have been conducted to determine the effect of various methods of cooking on the loss of vitamins from meat, vegetables and other foods (14, 15, 16). In general, all of these studies indicate that with proper cooking methods, conservation of cooking liquors and meat drippings, and the like, the loss of nutrients through cooking can be materially reduced. Research on vitamin and mineral losses in large-scale cookery is relatively new. As it is extended and results and practical remedies are made available to plant managements, this field of endeavor may be expected to develop. One of the major goals of the industrial nutrition program is to impress this information upon those responsible for large-scale preparation of food and thereby to establish universally improved food preparation methods.

Metabolic Stress: Illness, increased working hours, extremes of temperature, speedup of work, insufficient rest, exposure to toxic fumes, materially increase nutritional requirements above usual levels. Also, these situations may interfere with food intake, thereby further aggravating the condition of metabolic stress.

(Physical Activity): Caloric requirements for laborers in shipyards, for example, range between 3000—5000 calories per day, usually being more nearly 5000. The diet surveys cited indicate that most of the workers fail to meet even the 3000 level, yet these men are doing heavy labor necessitating extra food for good health and working efficiency. Vitamin intake was correspondingly low. Experimental evidence cited by Williams *et al* (10) shows that adults maintained on diets low in thiamine developed fatigue lassitude, loss of appetite and disinclination to work; in addition to depression, irritability, muscle soreness and backaches. These symptoms appeared first among the most active workers and were relieved in all the subjects upon the addition of

sufficient thiamine to the diet. Likewise, Johnson *et al* (17) have pointed out the need for an adequate daily intake of the B complex for maximum physical fitness. They reported results similar to those of Williams and co-workers after subjecting men on a deficient diet to hard, physical work for one week. The addition of vitamin B_1 improved the condition of the men while supplements of the entire B complex completely restored them to normal.

(Heat Losses): There has been some indication that exposure to high temperatures may increase certain vitamin requirements because of losses in sweating (18). A number of studies have been reported on the composition of sweat under normal conditions, and during exposure to heat or severe exercise (19, 20, 21). In general, it has been found that the most serious loss in sweat is that of salt, the amounts of water-soluble vitamins excreted being relatively insignificant unless, of course, sweat production becomes unusually excessive. The possibility does exist, however, that a worker, already on an inadequate diet may suffer somewhat from such loss of ascorbic acid and the B vitamins under severe conditions of work or temperature.

(Exposure to Toxic Substances): Milk has long been known as an effective agent in the prevention of lead poisoning among workers exposed to this type of industrial hazard (22). Several reports have appeared on the possible value of vitamin C as a detoxicant for such poisons as benzene, toluene, T.N.T., and zinc, but these have not yet, for the most part, been confirmed (23, 24). Cowgill states:

> "These illustrations emphasize to us the need for due appreciation of the *special industrial situation* for which one or more vitamins may be of great importance; and if the data from carefully controlled studies in this field prove a relationship of this type, obviously the dietary factor of interest should be provided whether it be a vitamin, table salt, calcium or some other substance."

Medical Evaluation of Nutritional Status:

With the special clinical and laboratory methods recently made available for detecting sub-acute malnutrition,* it is possible to examine workers and check on their health as affected by reported dietary inadequacies. To date there have been only fragmentary reports on this phase of nutritional conditions among workers. Without exception, however, all have confirmed observations of survey workers on the inadequate nature of the average worker's diet.

For example, a report issued in 1941 by Wiehl and Kruse (25) on the nutritional status of selected income groups, including WPA workers, in New York City as determined by clinical examination,

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**cf. Borden's Review of Nutrition Research*, February, 1945, "Diagnosing Nutritional Deficiencies."

reveals a high incidence of at least four sub-clinical deficiency diseases. These were avitaminosis A and ariboflavinosis, both detected through biomicroscopic examination of the eyes; iron-deficiency anemia (determined through blood tests); and avitaminosis C (detected through measurements of the plasma level of the vitamin). Their results showed that among the WPA workers, over 26 per cent of 165 adults of both sexes were deficient in blood-plasma ascorbic acid with less than 0.20 mg. per cent. Over 40 per cent had less than 0.40, and over 55 per cent had less than 0.60 mg. per cent (normal is about 0.70 mg. per cent). As for the incidence of anemias, 7.6 per cent of the males had less than 14 grams of hemoglobin per hundred cc. of blood, and 6.8 per cent of the females had less than 12 grams, the minimum limits of the normal range for males and females, respectively. Keratitis (inflammation of the cornea), indicating a deficiency of riboflavin, was found in 38.4 per cent of 138 persons examined. The most common of the deficiencies was avitaminosis A, revealed by characteristic changes in the conjunctiva. Marked changes were observed in 65 of 143 persons examined, while only one of the entire group was classified as completely normal. The members of this group showed plainly in their work the results of the nutritional deficiencies from which they suffered. When treated with large and prolonged doses of the required nutrient, the improvements were striking.

Similar studies are reported by Borsook (26) as a follow-up of the diet surveys at Lockheed. Reports on about 1,000 men reveal:

Forty-two per cent had plasma ascorbic acid levels of less than 0.5 mg. per 100 cc. (17 per cent less than 0.25 mg.). Nineteen per cent showed premature degeneration of the nervous system, as evidenced by loss of vibratory sensation in the toes to a C256 tuning fork (generally accepted as pathologic in men under 35 years of age). Forty-seven per cent presented gross vitamin A deficiency evidenced by localized elevated conjunctival spots. Twenty-eight and six-tenths per cent had a hemoglobin content of less than 14 gm. per 100 cc.

All these reports reflect the questionable nutritional situation among workers and the impaired health and reduced efficiency thereby resulting. The need for a vigorous and effective industrial nutrition campaign, both educational and practical, appears undeniable. Such a campaign has begun. Outstanding results have already been reported by plant managers and nutrition authorities who find improved nutrition of workers pays dividends not only in improved health and morale, but in increased efficiency and productivity.

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NEWS DIGEST

NEW FOOD TEST – Following the discovery that it is possible to measure quality of stored eggs by their development of fluorescence, measurements have been tried on other types of foods. A correlation has been discovered between fluorescence and the palatability of foods such as pork, bananas, linseed oil and various carbohydrates. Further applications of fluorescence to testing of food quality seems to be indicated. U. S. Ind. Chem. News, Dec. (1944).

PROTEIN DEFICIENCY AND SURGERY—It has been demonstrated by both immunologic and chemical methods that in the blood serum of protein deficient rats there is a lowered concentration of antibody globulin fractions. This indicates the adverse action of protein deficiency on protein reserves. In many surgical conditions serum protein fractions are lost through exudates, hemorrhage or the kidneys. Furthermore, undernutrition caused by an inadequate intake, absorption or utilization of high quality protein may lead to depletion of the tissue protein reserves both before and after operation. This loss of tissue proteins may become critical if and when a potentially pathogenic micro-organism enters tissues unprepared to mobilize the forces of acquired resistance. In patients with depleted globulin reserves repletion necessitates the ingestion or intravenous administration of proteins containing all of the essential amino acids. The further effects will depend on the patient's ability to convert these amino acids into tissue proteins, including antibodies. *Abstr. J. Am. Med. Assoc. 127,* 184 (1945).

METABOLISM AND NUTRITIONAL REQUIREMENTS – Studies on young men during physical effort and athletic training indicate an increased utilization of certain nutritive essentials resulting from the heightened metabolism engendered during these periods. Blood and urine tests made on four young men during fasting and after severe exercise and urinalyses after rest revealed a marked reduction of easily dissociable iron in the blood serum, and of thiamine and riboflavin in the urine following eight hours of severe exercise. Following a night's rest, urine thiamine values returned to normal, but the riboflavin still remained low. Similar studies were conducted with six young men during a three weeks' ski training course. Tests were made on the 3rd, 12th and 23rd days of training. For the first ten days the dissociable iron in the blood serum fell, while that of the non-dissociable fraction rose; these values subsequently returning to normal. Values for thiamine and riboflavin continued to drop throughout the experiment. The authors conclude that thiamine, riboflavin and dissociable iron of the blood plasma are all concerned with catalytic actions in tissue metabolism and disappear rapidly when metabolism is heightened. *Schweiz. Med. Wochenschr. 73,* 1026 (1943).

CAKES AND PIES – Commercial samples of 50 different cakes and 50 different pies were analyzed for vitamins A, B_1, riboflavin, niacin and ascorbic acid and for calcium and iron. The relation of the vitamin and mineral content of the cakes and pies to the calories furnished was calculated. All the cakes were found to contain inadequate amounts of thiamine, niacin, riboflavin and calcium. The iron content was satisfactory. Fruit pies, except for iron, were generally inadequate. Pumpkin, coconut custard and pineapple cheese pies are three outstanding pies for their vitamins, minerals, and protein. The authors suggested the enrichment of cakes with thiamine, riboflavin, niacin and calcium, and of fruit pies with ascorbic acid as a means of improving their contribution to a balanced diet.—*Cereal Chem. 20,* 661 (1943).